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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/669,732	09/26/2000	Tetsuro Nakasugi	04329.2439	5628

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FINNEGAN, HENDERSON, FARABOW, GARRETT &
DUNNER LLP
1300 I STREET, NW
WASHINGTON, DC 20006

EXAMINER	
JOHNSTON, PHILLIP A	
ART UNIT	**PAPER NUMBER**
2881	

DATE MAILED: 02/12/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

Office Action Summary	Application No.	Applicant(s)
	09/669,732	NAKASUGI ET AL.
	Examiner	Art Unit
	Phillip A Johnston	2881

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 09 January 2003.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-24 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-24 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 26 September 2000 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☒ The proposed drawing correction filed on 09 January 2003 is: a)☒ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

Detailed Action

1. Applicants arguments are moot in view of new grounds for rejection.

Claims Rejection – 35 U.S.C. 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,172,365, to Hiroi, in view of Zhao, U. S. Patent No. 6,157,087, and in further view of Hosono, U. S. Patent No. 5,093,572.

Regarding Claims 1-4, and 11-14, Hiroi (365) discloses an electron beam inspection apparatus that includes an electron source, a beam deflector for deflecting an electron beam emitted from the electron source, an objective lens for focusing the electron beam emitted from the electron source upon an object, a sensor for detecting a physical change generated from the object, upon exposure of the object to the electron beam, inspection condition creation means for creating inspection conditions corresponding to a charge-up phenomenon on a surface of the object according to a kind or a change of a section structure on the surface of the object, image processing

means for conducting inspection or measurement of the object on the basis of a signal representing a physical change detected from the sensor, under the inspection conditions created by the inspection condition creation means. See Column 7, line 9-22.

Hiroi (365) also discloses an electron beam inspection method that includes an inspection condition setter 28. By specifying a process index and an object index representing the surface section structure of the object 20, the inspection condition setter 28 stores the inspection conditions (such as conditions of the above described two parameters [the acceleration voltage E of the electron beam for the object, and the electric field on the object, or the charge-up phenomenon to the pattern located in the upper layer and charge-up ease phenomenon [diffusion phenomenon of the electric charge charged up]) for each group of objects (for every objects having the same surface structure). The inspection condition setter 28 thus sets inspection conditions. The present system further includes a deflection controller 47 for controlling the beam deflector 15, a stage controller 50 for controlling the wafer holder 21, and a whole controller 26 for controlling the whole of them. See Column 17, line 9-27.

Hiroi (365) further teaches that , since the charge-up ease phenomenon (diffusion phenomenon of electric charge charged up) occurs in the pattern especially located in the upper layer, there occurs a difference in the image signal detected by the sensor 11 according to whether the scan direction of the electron beam is the X

direction or Y direction as shown in FIGS. 6B and 6C. Therefore, it is necessary to set especially the acceleration voltage E of the electron beam used to irradiate the object and the electric field on the object at proper values so as to reduce as far as possible the difference between an image signal detected by the sensor 11 when the scan direction of the electron beam with respect to the object 20 is the X direction and that when the scan direction of the electron beam is the Y direction. See Column 14, line 33-46.

Hiroi (365) also discloses that, in order to correspond to the process index or object index representing the surface structure of the object 20, the material (i.e., material of the upper layer pattern) located in the upper layer of a section structure including a plurality of materials and forming the object (i.e., object to be inspected), the material (i.e., material of the lower layer pattern) located in the lower layer, the layer thickness and shape of the upper layer pattern, and the scan condition of the electron beam are specified by using the input device 135. The CPU 131 selects inspection conditions suitable for the surface structure of the specified object 20 from the above described relation table stored in the external storage device 137, stores the inspection conditions in the RAM 134 and the like in association with the process index or object index representing the surface structure of the object 20. It is a matter of course that the inspection conditions must be chosen with due regard to the layer thickness and shape of the upper layer pattern and the scan condition of the electron beam . See Column 23, line 44-67, and Column 24, line 1-6.

Hiroi (365) further discloses that the structural feature value extractor 263 extracts the feature value of the surface section structure of the object on the basis of the data (position information) 221 of deflection value (scan value) of the electron beam supplied from the deflection controller 47 to the beam deflector 15 and displacement value (travel value) representing the value of the travel of the stage effected by the stage controller 50. See Column 44, line 42-49.

It is implied herein that specifying the process and object index, and setting the scan sequence in accordance with Hiroi (365), is equivalent to "generating a table in which a scan order is associated with scan positions", as recited in Claims 1 and 11.

It is also implied herein that setting inspection conditions based upon scan conditions and scan values as taught by Hiroi (365), can also be used to provide for "selecting scan positions at random", as recited in Claim 2.

Hiroi (365) further teaches that a pattern, which can be detected as the same digital image signal even if the scan direction is changed by 180 degrees on the object is registered beforehand in the reference. By specifying a position of the pattern, an electron beam 172 used to irradiate the pattern 171 is aligned via the whole controller 26 as shown in FIG. 17. Thereafter, the scan direction of the electron beam is changed with respect to the pattern 171 by 180 degrees, as recited in Claims 3 and 4. Reciprocating scanning is thus conducted with the electron beam 172 as represented by 173 and 174. A digital image signal obtained from one of scan lines is inverted by 180 degrees so as to form a mirror image. This inverted digital image signal is

compared with a digital image signal obtained from the other scan line, and the degree of their coincidence is calculated. See column 30, line 46-59.

Regarding Claims 5,6,9,10 and15-18, Hiroi (365), discloses an electron beam inspection method, which includes the steps of exposing a sample having a pattern formed on a surface thereof to an electron beam, controlling an acceleration voltage of the electron beam and an electric field in neighborhood of the sample according to the material in an area on the sample exposed to the electron beam, detecting secondary electrons or back-scattered electrons generated from the sample, and thereby inspecting the pattern on the sample. See Column 8, line 48-56

Hiroi (365) also discloses that the pattern of the object is formed by a material A8 and a material B9 , as shown in FIG.7, an object having a solid section structure and including a lower layer made of the material B8 and an upper layer made of the material B4 (such as an interlayer insulator which is a dielectric) is exposed to an electron beam 5. It is now assumed that such a condition that the material B9 is charged up so as to be positive is then satisfied. In other words, the secondary electron yield ratio is unity or more. In addition, it is also assumed that such a condition that the material A8 is charged up so as to be negative is satisfied. In other words, the secondary electron yield ratio is unity or less. See Column 12, line 54-67, and Column 13, line 1-13.

Hiroi (365) further discloses that the sequence of this system, includes the following steps: setting the inspection conditions at the time of inspection as shown in

FIG. 14A. At step 31a, the object 20 is loaded. At step 32a, the object 20 is aligned. See Column 17, line 41-49.

Hiroi (365), as applied to claims 1-4, and 11-14 above, discloses an inspection method that includes nearly all the limitations of Claims 5,6,9,10 and15-18, but does not teach the use of a first mark and a second mark formed on a substrate serving as a reference for alignment exposure. Zhao (087); however, discloses in Figure 1A, a cross-section of a portion of a semiconductor wafer 101 during fabrication having a trench 100 etched in a surface layer 102 to provide a mold for an alignment mark . The alignment mark trench is typically adjacent to a die on the semiconductor wafer, and each die typically has several alignment marks associated with it. In a preferred embodiment, the surface layer 102 is a dielectric layer, such as an oxide, nitride, polymer, or composite of these.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made, that one could design an electron beam inspection method and apparatus according to Hiroi (365) and use alignment marks in accordance with the teaching of Zhao (087).

Regarding Claim 7,8, and 19-24, Hiroi (365) discloses that the charge-up phenomenon can be changed and the detected image signal can be made proper also by controlling the beam current on the object, beam diameter, image detection rate (which is the clock frequency for reading image signals and which changes the beam current density), or the image dimension (which is changed by changing the scan rate

of the electron beam and consequently the beam current density). See Column 15, line 3-10.

Hiroi (365) in view of Zhao (087) as applied above disclosed an inspection method and apparatus that includes nearly all the limitations of Claims 7,8, and 19-24, but does not disclose the use of different beam sources. Hosono (572); however discloses in FIG. 1, a scanning electron microscope for cross section observation that comprises an SEM column 100, an FIB column 200 and a sample chamber 300. See Column 4, line 37-39.

Hence, it would have been obvious to one of ordinary skill in the art at the time the invention was made, that one could design an electron beam inspection method and apparatus according to Hiroi (365) in view of Zhao (087) and use the two particle beams of Hosono (572) to simultaneously scan the sample if so desired.

Conclusion

4. Any inquiry concerning this communication or earlier communications should be directed to Phillip Johnston whose telephone number is (703) 305-7022. The examiner can normally be reached on Monday-Friday from 7:30 am to 4:00 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiners supervisor John Lee can be reached at (703) 308-4116. The fax phone numbers are (703) 872-9318 for regular response activity, and (703) 872-9319 for after-final responses. In addition the customer service fax number is (703) 872- 9317.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 0956.

PJ
February 7, 2003

JOHN R. LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800